Microwave Absorption of 1D Molecular Wires Supported by Pd-Pd Bonds

A. Kovalev (NHMFL); S. Hill (NHMFL and FSU Physics); M.G. Campbell, T. Ritter (Harvard U., Chemistry and Chemical Biology)

Introduction

One-dimensional metal wires are valuable materials because of their optical and electronic anisotropy, and their potential utility in devices such as photovoltaic cells and molecular sensors. Herein we measured the first examples of 1D molecular wires supported by Pd–Pd bonds [1]. There were two samples in powder form: wires based on Pd(III), and wires based on Pd(2.5). To estimate the conductivity of the materials, we measured the microwave absorption of the sample in the range 10-20 GHz at different temperatures.

Experimental

The measurements were performed on a modified PPMS Quantum Design system in the 5-250 K temperature range. Since the samples were known to decompose at room temperature, care was taken to keep them below 250 K at all times. The measurements were performed using a cavity perturbation technique. First, the empty vial was placed into the cavity and the cavity Q-factor and resonance frequency were measured at several temperatures for a few different cavity modes. Second, the quartz vial with the sample in powder form was placed into the cavity and the measurements were repeated. The change of the Q-factor due to the sample was then calculated. The sample absorption was determined from the inverse of the change in the Q-factor; the results are shown in **Figure 1**.

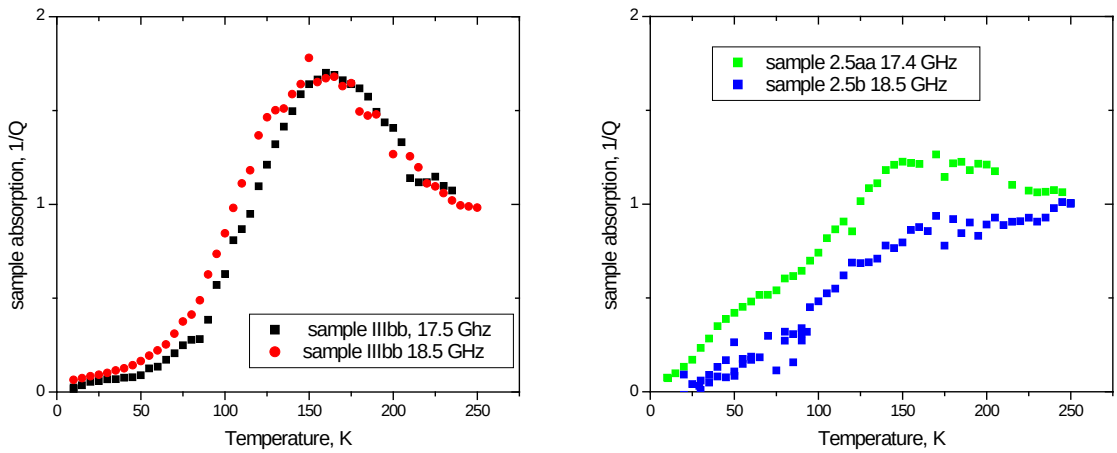

Figure 1. Temperature dependence of the microwave absorption of the Pd(III) and Pd(2.5) samples**.**

Results and Discussion

As seen in **Figure 1**, the microwave absorption for the Pd(III) sample has a maximum at about 15 0K while the microwave absorption of the Pd(2.5) sample decreases more or less monotonically. These data contrast the DC conductivity data, and the reason for this is currently under investigation.

References

[1] Campbell, M.G, *et al.,* Nature Chemistry, **3**, 949-953 (2011).